

FINAL REPORT ON ERADICATION OF THE INVASIVE SEAWEED *CAULERPA TAXIFOLIA* FROM AGUA HEDIONDA LAGOON AND HUNTINGTON HARBOUR, CALIFORNIA

EXECUTIVE SUMMARY

In summer 2000, the first known Western Hemisphere infestations of the invasive strain of the tropical marine alga, *Caulerpa taxifolia*, were discovered in Agua Hedionda Lagoon, Carlsbad, California and in Huntington Harbour, Huntington Beach, California. Commonly used in saltwater aquarium systems, earlier releases of *C. taxifolia* into coastal European and Australian waters have resulted in the establishment of extensive dense carpets of the seaweed, smothering diverse natural communities and dramatically reducing biodiversity by displacing native seaweeds and animals. Based on the aggressive nature of this species and the displacement of native marine resources observed upon its discovery in California, it was recognized that the infestations posed a major threat to coastal ecosystems, and recreational and commercial uses dependent upon coastal resources.

Following the discovery in Carlsbad, a team of resource and regulatory agencies, marine biologists, and stakeholders were brought together under the name of the Southern California *Caulerpa* Action Team (SCCAT). The SCCAT Steering Committee is comprised of representatives from the San Diego Regional Water Quality Control Board, California Department of Fish and Game, National Oceanic and Atmospheric Administration National Marine Fisheries Service (Chair), Santa Ana Regional Water Quality Control Board, and U.S. Department of Agriculture-Agricultural Research Service. The goals of the SCCAT are the eradication of the known infestations of *C. taxifolia*, and the prevention and detection of new infestations through outreach and surveillance. Eradication efforts have been ongoing since June 2000 at a cost of over \$7,000,000.

The criteria for successful eradication of the *C. taxifolia* infestations are 1) the containment and lethal treatment of *C. taxifolia* at the infestation site, and 2) verified absence of *C. taxifolia* from the infestation site. Treatment efforts consisted of covering *C. taxifolia* with heavy black PVC tarps under which chlorine was either injected as sodium hypochlorite, or placed as a solid, pelleted formulation, which provided full containment of *C. taxifolia* while minimizing the water quality impacts of the treatment on the surrounding waters. The containment and treatment efforts lasted approximately two years, with divers undertaking intensive surveillance concurrently to search for remaining *C. taxifolia*. *Caulerpa taxifolia* was last detected in Agua Hedionda Lagoon in September 2002 and in Huntington Harbour in November 2002. No *C. taxifolia* has been discovered at either site during intensive, systematic surveillance conducted through December 2005.

Evaluations of the treatment effectiveness have been performed both in the laboratory and at both infestation sites. The laboratory experiments involved the collection of previously infested sediment from under the treatment tarps. The sediment cores were planted into laboratory aquariums and monitored in a controlled study for regrowth of *C. taxifolia*. No *C. taxifolia* grew from any of the treated cores. Additionally, removal of portions of the treatment tarps at the infestation sites resulted in no regrowth of *C. taxifolia* after four years of monitoring. These data indicate that the treatment approach used was lethal to *C. taxifolia* and that Eradication Criterion 1 has been met at both sites.

The second criterion was evaluated by quantifying the confidence in the surveillance efforts at both infestation sites. Patches of artificial *Caulerpa* were placed within each of the two sites during the regular diver surveys. Confidence in the results of each survey for live *C. taxifolia* could then be quantitatively

estimated based on the amount of artificial *Caulerpa* found during the surveys. The results of these consecutive assessments of the surveys ultimately allowed for an estimation of the eradication certainty, the certainty that all real *C. taxifolia* existing at the two sites had been found and that eradication had been achieved. The assessments determined that there is a 97.71% certainty that eradication has been achieved at Agua Hedionda Lagoon, assuming the worst conditions, and a 99.86% certainty if the average conditions are assumed. There is a 99.99% certainty that eradication has been achieved at Huntington Harbour under all conditions. These results indicate that Criterion 2 has also been met at both sites with a high degree of certainty.

Based on the results of the work performed, SCCAT believes that the criteria necessary to verify and document eradication of *Caulerpa taxifolia* at Agua Hedionda Lagoon and Huntington Harbour have been met.